

REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

To place the application in better form, the specification has been amended to correct minor informalities, including those noted by the Examiner. No new matter has been added by these changes.

Claims 27-50 are presented for consideration. Claims 27, 36 and 47-50 are independent. Claims 27, 36 and 47-50 have been amended to clarify features of the subject invention. Support for these changes can be found in the application, as originally filed. Therefore, no new matter has been added.

Applicant requests favorable reconsideration and withdrawal of the objections and rejection set forth in the Office Action.

The drawings were objected to on formal grounds. Specifically, the Examiner asserted that reference characters MCX and MCY of Figs. 6 and 8, and MB of Fig. 8, were not mentioned in the subject disclosure. By separate paper, Applicant requests approval to amend Fig. 8 to delete reference characters MCX and MCY and their respective lead lines and control lines. Applicant respectfully submits, however, that it is not necessary to add reference characters MCX and MCY to Fig. 6 or Fig. 8. Page 23, lines 8-16, of the subject specification discuss that MCX is a central position of the mark WAMX and MCY is a central position of the mark WAMY. In general, patterns or structures corresponding to the central positions MCX and MCY do not exist on the marks WAMX and WAMY, themselves. Rather, central positions MCX and MCY are

calculated based on image data obtained by the image sensing system. Accordingly, Applicant requests reconsideration and withdrawal of this portion of the objection to the drawings. Further, to expedite prosecution, Applicant has amended reference character MB in Fig. 8 to read -- SHT --. This reference character is discussed on page 29, at line 10. Favorable consideration is requested.

The specification was objected to on formal grounds. Applicant has amended the subject specification at page 37, line 9, to change step "SAS001" to -- SAS011 --, as suggested by the Examiner. Regarding the Examiner's remaining objections to the specification and drawings, reference character LN in Fig. 1 is discussed on page 13 at line 22, reference character WS in Fig. 1 is discussed on page 16 at line 20, reference character WAP in Fig. 1 is discussed on page 16 at line 19, reference character CMY in Fig. 2 is discussed on page 30 at line 21, step S005 in Fig. 3 is discussed on page 18 at line 4, reference character WAP in Fig. 6 is discussed on page 16 at line 19, baseline BLOAS in Fig. 7 is discussed on page 25 at line 6, reference character RS in Fig. 8 is now discussed on page 29 at line 6, reference character SHT in Fig. 8 is now shown in Fig. 8, reference character LSY in Fig. 8 is discussed on page 30 at line 4, reference characters MX and MY in Fig. 8 have now been deleted, step SAC011 in Fig. 11 is discussed on page 38 at lines 10-11, steps S1-S7 in Fig. 12 are now discussed on page 41, and steps S11-S19 in Figure 13 are now discussed on pages 41-42. Applicant submits that these changes overcome the Examiner's objections to the specification and drawings. Such favorable indication is requested.

Turning now to the art rejection, claims 27-50 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,243,195 to Nishi. Applicant submits that this patent does

not teach many features of the present invention as previously recited in these claims. Therefore, this rejection is respectfully traversed. Nevertheless, Applicant submits that independent claims 27, 36 and 47-50, for example, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, independent claim 27 recites an apparatus for determining a position of a mark on an object placed on a stage. The apparatus includes an image sensing system which has an image sensor and obtains image data of the mark by accumulating image signals corresponding to an image of the mark within the image sensor during an accumulation period, a measurement system which measures a position of the stage plural times during the accumulation period of the image sensing system, and an arithmetic section which calculates the position of the mark based on the image data obtained by the image sensing system and the positions of the stage measured by the measurement system.

In another aspect of the present invention, independent claim 36 recites an exposure apparatus including a stage on which a substrate is placed, a lens section which projects a pattern onto the substrate, a first measurement system which has an image sensor and measures a position of a mark formed on the substrate based on image data of the mark that is obtained by accumulating image signals corresponding to an image of the mark within the image sensor during an accumulation period, a second measurement system which measures a position of the stage plural times during the accumulation period of the measurement system, a calculation section which calculates the position of the mark based on a measurement result by the first measurement system and measurement results by the second measurement system, and a

positioning system which drives the stage based on the position of the mark calculated by the calculation section.

In a further aspect of the present invention, independent claim 47 recites a method for determining a position of a mark on an object placed on a stage. The method includes the steps of first measuring of a position of a mark formed on the object based on image data of the mark that is obtained by accumulating image signals corresponding to an image of the mark within an image sensor during an accumulation period, second measuring of a position of the stage plural times during the accumulation period in the first measuring step, and calculating the position of the mark based on a measurement result in the first measuring step and measurement results in the second measuring step.

In still another aspect of the present invention, independent claim 48 recites a method adapted for an exposure apparatus having a stage on which a substrate is placed, and a lens section which projects a pattern onto the substrate. The method includes the steps of first measuring of a position of a mark formed on the substrate based on image data of the mark that is obtained by accumulating image signals corresponding to an image of the mark within an image sensor during an accumulation period, second measuring of a position of the stage plural times during the accumulation period in the first measuring step, calculating the position of the mark based on a measurement result in the first measuring step and measurement results in the second measuring step, and driving the stage based on the position of the mark calculated in the calculating step.

In yet another aspect of the present invention, independent claim 49 recites a method of manufacturing a device, using an exposure apparatus having a stage on which a substrate is placed, and a lens section which projects a pattern onto the substrate. The method includes the steps of placing the substrate applied with a resist on the stage, first measuring of a position of a mark formed on the substrate based on image data of the mark that is obtained by accumulating image signals corresponding to an image of the mark within an image sensor during an accumulation period, second measuring of a position of the stage plural times during the accumulation period in the first measuring step, calculating the position of the mark based on a measurement result in the first measuring step and measurement results in the second measuring step, aligning the substrate using the stage in the exposure apparatus based on the position of the mark calculated in the calculating step, and transferring a pattern to the substrate using the lens section.

In a still further aspect of the present invention, independent claim 50 recites an apparatus for determining a position of a mark on an object placed on a stage. The apparatus includes a first measurement system which has an image sensor and measures the position of the mark based on image data of the mark that is obtained by accumulating image signals corresponding to an image of the mark within an image sensor during an accumulation period, a second measurement system which measures a position of the stage plural times during the accumulation period of the first measurement system, and a calculation section which calculates the position of the mark based on a measurement result by the first measurement system and measurement results by the second measurement system.

In this manner, image data of a mark can be obtained by accumulating image signals corresponding to an image of the mark within an image sensor during an accumulation period, a position of, for example, a stage can be measured plural times during the accumulation period, and the position of the mark can be calculated based on the obtained image data and the measured positions of the stage. Such image data can contain “swing” or “vibration” information of the mark and can provide an averaged position of the mark. This is discussed in more detail on page 19, line 3-14, of the subject specification.

Applicant submits that the cited art does not teach or suggest such features of the present invention, as recited in the independent claims.

The Nishi patent discloses a photoelectric sensor 121, which is a photomultiplier. This is discussed in the Nishi patent at column 11, line 50, to column 12, line 7. The sensor 121 detects an amount of incident light to generate signals SSD, while a light emission mark IFS scans the reticle RM₁. The signals SSD are digital-sampled to present a waveform in accordance with the up and down pulse output from interferometers IFX and IFY₂. Applicant submits, however, that the arrangement in the Nishi patent is quite different from that of the present invention recited in the independent claims. In this regard, Applicant submits that the sensor or photomultiplier 121 in the Nishi patent does not accumulate image signals corresponding to a mark image, in the manner of the present invention. Applicant submits, therefore, that the Nishi patent fails to teach or suggest the ability to determine a position of a swinging mark or vibrating mark, in the manner of the present invention recited in the independent claims. For the noted reasons, Applicant submits that the Nishi patent does not teach or suggest salient features of Applicant’s present

invention, as recited in the independent claims, including at least the feature of obtaining image data of a mark by accumulating image signals corresponding to an image of the mark within an image sensor during an accumulation period. Accordingly, Applicant submits that the Nishi patent should not be read to anticipate or render obvious Applicant's present invention recited in the independent claims.


For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 27, 36 and 47-50, is patentably defined over the cited art.

Dependent claims 28-35 and 37-46 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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